

Attachment 7

Economic Analysis – Flood Damage Reduction Costs and Benefits

Rohner Creek Flood Control and Riparian Habitat Improvement Project

This attachment provides supporting information for the project costs and evaluation of avoided flood damage costs resulting from the implementation of the Rohner Creek Flood Control and Riparian Habitat Enhancement Project.

Project Costs

The project costs were developed based on work completed to date and estimates from other similar types of project. The City worked closely with one of its engineering consultants on the development of the project tasks and costs. This was especially useful for the development of the construction costs. The City's consultant is in the process of completing similar scale projects and had recently bid similar project, and the same consultant is working with the City on development of the preliminary alternatives. Thus, the construction costs presented are robust and reflect a reasonable estimate of the construction cost of the proposed project.

Annual administrative costs will consist of City assistance in explaining right of way and easements to new landowners and responding to calls about repairs needed within City easements and rights of way along the Creek. Annual operations costs consist of the City's continuing stream flow monitoring including maintenance of crest gages and measuring surface water heights for at least the first five years after the Grant is complete. Periodic surveys of the channel thalweg will be performed as well. After the first five years of the project, monitoring frequency will be reduced to a 5-year cycle, with potential intermittent additional monitoring for very large storm events. Maintenance costs include selective vegetation maintenance in compliance with the re-vegetation plan, inspection of new stormwater facilities, re-planting in areas where native vegetation is not thriving, and minor fencing maintenance. Also under maintenance will be the City's response to property owner calls. It is anticipated that minor maintenance will be needed on an annual basis, and more extensive maintenance every five years. It is also anticipated that maintenance costs will be slightly higher in the first years as new vegetation is established. With the operations and maintenance activities described above, the City will not need to replace project components within the 50 year life of the project.

Flood Damage Modeling

The project flood damage costs were estimated using the Flood Rapid Appraisal Method (F-RAM) model developed for the Department of Water Resources to assess the benefits (reduction in flood damage) of levee repairs and modified for use as a generic benefit cost analysis (BCA) model to rapidly assess the benefits of flood mitigation projects. The City of Fortuna has not kept historic records of damage claims from flood events, which made the use of the F-RAM model for this analysis especially useful.

F-RAM Model Inputs (Pre-Project)

This section describes how the F-RAM model inputs were developed for both pre-project and post-project conditions. The first step was to identify three flood events to enter into the model that would provide meaningful information about the project flood reduction benefits. The project area floods on a regular basis some areas as frequently as every two years, however accurate information on the extent of that flooding was not available. This most accurate information readily available for flood extent and depth was from the work FEMA conducted in development of the City of Fortuna Flood Insurance Study (FIS) and resulting Flood Insurance Rate Maps (FIRMs). FEMA evaluated the 10-year, 50-year, 100-year, and 500-year recurrence events. All but the 500-year event were included in the analysis.

The pre-project aerial extent of the 100-year, 50-year, and 10-year average return interval events was determined using geographic information systems (GIS). The 100-year return event aerial extent was taken directly from FEMA GIS data used in the development of the FIRM maps. Similar data was not available for the 50-year or 10-year events. As part of the City's on-going study of Rohner Creek the FEMA HEC-2 model used in the development of the FIS was obtained. Included with the model are cross sections along Rohner Creek showing the depth and extent of flood waters for the 50-year and 10-year events (as well as the 100-year event). This information was translated into the GIS. A table of parcels affected by flooding for the three different events was developed by intersecting the City's GIS parcel database with the three flood polygons. This resulted in a table of affected parcels. Each parcel was reviewed with aerial mapping to determine the type and size of structures located on the parcels. This table was then taken into the field to verify that the correct type of structure was assigned.

The types of commercial establishments in the flooded areas included supermarkets, banks, storage facilities, offices, restaurants, and others. Table 7.1 below shows all the commercial establishments and the square footage of each included in the three different flood zones, which was inputted into the F-RAM model. Medium value was assigned to all the commercial facilities which was considered to represent the average value of the facilities as a whole.

There were two types of residential structures included in the flood areas, single-story and multi story with no basements. Homes built in the City of Fortuna do not have basements. Table 7.2 below shows all the structures included in the F-RAM model for the three flood events.

There were two types of roads included in the flood areas as defined in the F-RAM user model, major road and minor roads. Table 7.3 below shows the roads and length included in each flood event.

Table 7.1: Pre-Project Commercial Flood Inundation

Parcel No.	Property Acres	Inundation Area (Sq Ft)			Facility Description
		100-year	50-year	10-year	
4026305	0.2476	2,300	1,150	0	Extreme Audio- 2 story
4026308	0.226	3,200	1,600	0	Action Realty
4026344	0.4116	6,300	3,150	0	Office
4027301	0.0493	2,200	2,200	2,200	2 story office complex
4027302	0.0654	2,900	2,900	2,900	Karate School
4027303	0.0544	2,400	2,400	2,400	Flooring
4027304	0.1217	5,300	5,300	5,300	Office, taylor & paint
4027305	0.0537	2,400	2,400	2,400	Florist
4027402	0.1698	4,500	0	0	Main St Feed
4027612	0.1865	8,200	8,200	8,200	Hair Cutters
4028106	2.0494	13,000	13,000	13,000	Tattoo shop, restaurant
4028128	0.4008	9,000	9,000	1,200	Video store + 1 other
4028133	1.3729	17,500	17,500	0	Multiple shops
4028134	1.1342	15,000	0	0	Sport Cycle Bicycle Shop + 1 other
4028206	0.1393	6,100	6,100	6,100	Edward Jones
4028210	0.225	7,800	7,800	7,800	Fortuna Audio Concepts
4028211	1.9658	5,000	5,000	5,000	Insurance
4028212	1.0899	2,750	2,750	2,750	Auto Glass
4028227	2.8298	42,000	42,000	42,000	Multiple Office Units
4029101	0.8764	19,000	19,000	19,000	Tanning and Mini-storage
4029106	0.4054	3,500	0	0	Veterinary Clinic
4029111	2.052	16,500	16,500	16,500	Les Schwab
4029244	0.4255	4,500	4,500	4,500	Quick lube and Car Wash
4029245	1.8134	13,500	13,500	13,500	industrial storage
4029248	2.5734	30,000	3,000	0	Forestry and Fire Protection multiple units
4029253	0.2914	3,500	3,500	3,000	Mechanic
20106113	0.1601	1,000	0	0	Preston Center
TOTAL		249,350	192,450	157,750	

Table 7.2: Pre-Project Residential Flood Inundation

Parcel No.	Structure Type	Structures Affected			Parcel No.	Structure Type	Structures Affected		
		100-year	50-year	10-year			100-year	50-year	10-year
4027201	URS	1	0	0	4029217	URS	1	1	0
4027203	URS	1	0	0	4029218	URS	1	1	0
4027306	URS	1	1	1	4029219	URS	1	1	0
4027307	URS	1	1	1	4029220	URS	1	1	0
4027308	URS	1	1	1	4029221	URS	1	1	0
4027403	URS	1	0	0	4029222	URS	1	1	1
4027406	URS	1	1	0	4029223	URS	1	1	1
4027407	URS	1	1	0	4029224	URS	1	1	1
4027408	URS	1	1	1	4029225	URS	1	1	1
4027410	URS	1	1	1	4029227	URS	1	1	1
4027601	URS	1	1	1	4029228	URS	1	1	1
4027602	URS	1	1	1	4029236	URS	1	1	0
4027605	URS	1	1	1	4029237	URS	1	1	1
4027606	URS	1	1	1	4029238	URS	1	1	1
4027608	URS	1	1	1	4029239	URS	1	1	1
4027609	URS	1	1	1	4029241	URS	1	1	0
4027610	URS	1	1	1	4029252	URS	1	1	1
4027611	URS	1	1	1	20015129	URS	1	0	0
4027613	URS	1	1	1	20015130	URS	1	0	0
4027614	URS	1	1	1	4027202	URT	1	0	0
4028207	URS	1	1	1	4027603	URT	1	1	1
4028209	URS	1	1	1	4027604	URT	1	1	1
4028216	URS	1	1	1	4028205	URT	1	1	1
4028217	URS	1	1	1	4028213	URT	1	1	1
4028218	URS	1	1	1	4029207	URT	1	1	1
4029201	URS	1	1	0	4029240	URT	1	1	1
4029202	URS	1	1	0	20013213	URT	1	0	0
4029203	URS	1	1	0	20015127	URT	1	0	0
4029204	URS	1	1	0	20015127	URT	1	0	0
4029208	URS	1	1	0	20015127	URT	1	0	0
4029209	URS	1	1	0	20015127	URT	1	0	0
4029210	URS	1	1	0	20015127	URT	1	0	0
4029211	URS	1	1	0	20015127	URT	1	0	0
4029212	URS	1	1	0	20015127	URT	1	0	0
4029213	URS	1	1	0	20015127	URT	1	0	0
4029214	URS	1	1	0	20015132	URT	1	0	0
4029215	URS	1	1	0	20015132	URT	1	1	1
4029216	URS	1	1	0	20106125	URT	1	0	0
TOTAL URS		57	52	30					
TOTAL URT		19	7	7					

URS = Urban Residential Single Story – no basement

URT = Urban Residential Two Story – no basement

Table 7.3: Pre-Project Road Flood Inundation				
Road Name	Road Type	Inundation Length (Miles)		
		100-year	50-year	10-year
Main St.	Major Road	0.12	0.12	0.12
Fortuna Blvd.	Major Road	0.26	0.24	0.22
Major Road Sub-Total		0.38	0.36	0.34
Park Heights Ct.	Minor Road	0.02	0.01	0
Stillman Way	Minor Road	0.13	0.13	0.13
Beech St.	Minor Road	0.04	0.04	0.04
Ash St.	Minor Road	0.04	0.04	0.04
unknown rd.	Minor Road	0.05	0.05	0.05
Alder Dr.	Minor Road	0.15	0.15	0.04
Willow Dr.	Minor Road	0.11	0.11	0.05
David Way	Minor Road	0.06	0	0
Smith Ln.	Minor Road	0.07	0.05	0.03
Minor Road Sub-Total		0.67	0.58	0.38

The ratio of depreciated value to replacement value of 70% entered into the F-RAM model was estimated based on the median home age in Fortuna, 32 years obtained from a local real estate office, and the mean residential home depreciation for a home in average condition from the HAZUS-MH Flood Technical Manual (FEMA, 2010, page 14-17). Based on the presentation of depreciation model for non residential structures in the HAZUS model document (FEMA, 2010, page 14-18) it is reasonable to use a 70% ratio of depreciated value to replacement value for commercial structures, which assumes a similar age mix of commercial buildings.

The flood depth for the pre-project conditions was estimated by evaluating the cross sections from the FEMA HEC-2 model. A review of all the cross-sections along the Rohner Creek Channel in the project area was conducted. The flood depth was estimated as the difference between the ground surface and water surface elevation. The difference was averaged across the cross-sections and then along the river reach. The data was then entered in the F-RAM model. Once the pre-project model inputs were developed, the post-project conditions were estimated.

F-Ram Inputs (Post-Project)

In general, the post-project model inputs were developed from a combination of the FEMA HEC-2 model of Rohner Creek and the HEC-RAS Existing Condition Model developed by the City. The City is committed to containing the 10-year recurrence storm event, which has been shown to be feasible as part of the on-going HEC-RAS model development.

The post-project flood extent for the three recurrence events was estimated using GIS. The reduction in flood extent was evaluated by looking at the extent of reduction from containment of the 10-year storm

and then applying that reduction to the 50-year and 100-year events. Tables 7.4, 7.5, and 7.6 show the post-project flooded structure information for commercial and residential properties as well as roads.

The depth of flooding was estimated by comparing the post-project water surface elevation modeled in the City's HEC-RAS results to the ground surface elevation.

The same ratio of depreciated value to replacement value for residential and commercial buildings was used in the post-project analysis. Included at the end of this attachment is a copy of the F-RAM model Input data.

Table 7.4: Post-Project Commercial Flood Inundation					
Parcel No.	Property Acres	Inundation Area (Sq Ft)			Facility Description
		100-year	50-year	10-year	
4026305	0.2476	0	0	0	Extreme Audio- 2 story
4026308	0.226	0	0	0	Action Realty
4026344	0.4116	0	0	0	Office
4027301	0.0493	0	0	0	2 story office complex
4027302	0.0654	0	0	0	Karate School
4027303	0.0544	0	0	0	Flooring
4027304	0.1217	0	0	0	Office, taylor & paint
4027305	0.0537	0	0	0	Florist
4027402	0.1698	0	0	0	Main St Feed
4027612	0.1865	0	0	0	Hair Cutters
4028106	2.0494	13,000	13,000	0	Tattoo shop, restaurant
4028128	0.4008	9,000	9,000	0	Video store + 1 other
4028133	1.3729	0	0	0	Multiple shops
4028134	1.1342	0	0	0	Sport Cycle Bicycle Shop + 1 other
4028206	0.1393	0	0	0	Edward Jones
4028210	0.225	7,800	7,800	0	Fortuna Audio Concepts
4028211	1.9658	5,000	5,000	0	Insurance
4028212	1.0899	2,750	2,750	0	Auto Glass
4028227	2.8298	42,000	0	0	Multiple Office Units
4029101	0.8764	19,000	19,000	0	Tanning and Mini-storage
4029106	0.4054	0	0	0	Veterinary Clinic
4029111	2.052	16,500	16,500	0	Les Schwab
4029244	0.4255	4,500	4,500	0	Quick lube and Car Wash
4029245	1.8134	13,500	13,500	0	industrial storage
4029248	2.5734	30,000	3,000	0	Forestry and Fire Protection multiple units
4029253	0.2914	3,000	3,000	0	Mechanic
20106113	0.1601	0	0	0	Preston Center
TOTAL		166,050	97,050	0	

Table 7.5: Post-Project Residential Flood Inundation

Parcel No.	Structure Type	Structures Affected			Parcel No.	Structure Type	Structures Affected		
		100-year	50-year	10-year			100-year	50-year	10-year
4027201	URS	0	0	0	4029217	URS	1	0	0
4027203	URS	0	0	0	4029218	URS	1	1	0
4027306	URS	0	0	0	4029219	URS	1	1	0
4027307	URS	0	0	0	4029220	URS	1	1	0
4027308	URS	1	0	0	4029221	URS	1	1	0
4027403	URS	0	0	0	4029222	URS	1	1	0
4027406	URS	0	0	0	4029223	URS	1	1	0
4027407	URS	0	0	0	4029224	URS	1	1	0
4027408	URS	0	0	0	4029225	URS	1	1	0
4027410	URS	0	0	0	4029227	URS	1	1	0
4027601	URS	0	0	0	4029228	URS	1	1	0
4027602	URS	0	0	0	4029236	URS	1	1	0
4027605	URS	1	0	0	4029237	URS	1	1	0
4027606	URS	1	0	0	4029238	URS	1	1	0
4027608	URS	0	0	0	4029239	URS	1	1	0
4027609	URS	0	0	0	4029241	URS	1	1	0
4027610	URS	0	0	0	4029252	URS	1	1	0
4027611	URS	0	0	0	20015129	URS	0	0	0
4027613	URS	0	0	0	20015130	URS	0	0	0
4027614	URS	0	0	0	4027202	URT	0	0	0
4028207	URS	0	0	0	4027603	URT	1	0	0
4028209	URS	0	0	0	4027604	URT	1	0	0
4028216	URS	1	0	0	4028205	URT	0	0	0
4028217	URS	1	1	0	4028213	URT	1	1	0
4028218	URS	1	1	0	4029207	URT	1	1	0
4029201	URS	1	0	0	4029240	URT	1	1	0
4029202	URS	1	0	0	20013213	URT	0	0	0
4029203	URS	1	1	0	20015127	URT	0	0	0
4029204	URS	1	1	0	20015127	URT	0	0	0
4029208	URS	1	1	0	20015127	URT	0	0	0
4029209	URS	1	1	0	20015127	URT	0	0	0
4029210	URS	1	1	0	20015127	URT	0	0	0
4029211	URS	1	0	0	20015127	URT	0	0	0
4029212	URS	1	0	0	20015127	URT	0	0	0
4029213	URS	1	0	0	20015127	URT	0	0	0
4029214	URS	1	0	0	20015132	URT	0	0	0
4029215	URS	1	0	0	20015132	URT	0	0	0
4029216	URS	1	0	0	20106125	URT	1	0	0
TOTAL URS		36	23	0					
TOTAL URT		6	3	0					

URS = Urban Residential Single Story – no basement

URT = Urban Residential Two Story – no basement

Table 7.6: Post-Project Road Flood Inundation				
Road Name	Road Type	Inundation Length (Miles)		
		100-year	50-year	10-year
Main St.	Major Road	0	0	0
Fortuna Blvd.	Major Road	0.14	0.12	0
Major Road Sub-Total		.14	0.12	0
Park Heights Ct.	Minor Road	0	0	0
Stillman Way	Minor Road	0.09	0.09	0
Beech St.	Minor Road	0.02	0.02	0
Ash St.	Minor Road	0	0	0
unknown rd.	Minor Road	0	0	0
Alder Dr.	Minor Road	0.07	0.07	0
Willow Dr.	Minor Road	0.07	0.07	0
David Way	Minor Road	0	0	0
Smith Ln.	Minor Road	0.05	0.04	0
Minor Road Sub-Total		0.30	0.29	0

Model Results

The project benefits are listed below. The project costs were not entered into the F-RAM model. They were entered into DWR Table 10, including the annual reoccurring costs. These benefits were transferred into Table 12. The F-RAM model input and BCA summary are included in this attachment.

Benefits

	Actual	Potential
EAD without project	\$ 995,950	\$ 1,038,842
EAD with project	\$ 164,469	\$ 169,860
Annual Benefit:	\$ 831,481	\$ 868,982
PV of Future Benefits:	\$ 13,105,689	\$ 13,696,776

References

Federal Emergency Management Agency, 'Multi-hazard Loss Estimation Methodology, Flood Model, Hazus®-MH MR5, Technical Manual', Developed by: Department of Homeland Security, Federal Emergency Management Agency, Mitigation Division, Washington, D.C., 2010

Project Name:

City of Fortuna Rohner Creek Flood Control and Ripairan Habitat Improvement Project

Cost of Project:

Description:

Number of Events Modeled	3	Without Project						With Project					
		Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6
Average Return Interval (ARI)		10	50	100				10	50	100			
Annual Probability of Exceedance		0.100	0.020	0.010				0.100	0.020	0.010			
Probability of Levee Failure		1.00	1.00	1.00				1.00	1.00	1.00			
Water Surface Elevation - channel (f)		57.71	58.37	58.61				55.32	56.44	56.76			
Flood Warning Time (hours)		0	0	0				0	0	0			
Flood Experience		N	N	N				N	N	N			
Period of Inundation (days)		0.5	1	2				0	0.5	1.5			
HEC-FIA DATA INPUTS		N											
Residential Structural Damages (\$)													
Residential Contents Damages (\$)													
Residential Debris & Cleanup (\$)													
Commercial Structural Damages (\$)													
Commercial Contents Damages (\$)													
Commercial Debris & Cleanup (\$)													
Industrial Structural Damages (\$)													
Industrial Contents Damages (\$)													
Industrial Debris & Cleanup (\$)													
Agricultural Structural Damages (\$)													
Agricultural Contents Damages (\$)													
Agricultural Debris & Cleanup (\$)													
Residential Properties													
Ratio Depreciated Value to Replacement Value		70%	70%	70%				70%	70%	70%			
Average Flood depth above ground level (f)		1.50	2.30	3.10				0.00	1.00	2.00			
Rural - Res: Homesteads													
Rural - Other: Barns, sheds													
Urban Res: Single story (no base)		30	52	57				0	23	36			
Urban Res: Single story (basement)													
Urban Res: Two plus story (no base)		7	7	19				0	3	6			
Urban Res: Two plus story (basement)													
Mobile home													
Commercial Properties													
Ratio Depreciated Value to Replacement Value		70%	70%	70%				70%	70%	70%			
Average Flood depth above ground level (f)		1.50	2.30	3.10				0.00	1.00	2.00			
low value	building area inundated (sq.f.)												
medium value	building area inundated (sq.f.)	157750	192450	249350				0	97050	166050			
high value	building area inundated (sq.f.)												
Industrial Properties													
Ratio Depreciated Value to Replacement Value													
Average Flood depth above ground level (f)													
low value	building area inundated (sq.f.)												
medium value	building area inundated (sq.f.)												
high value	building area inundated (sq.f.)												
Agricultural Production													
Corn	ac.												
Rice	ac.												
Walnuts	ac.												
Almonds	ac.												
Cotton	ac.												
Tomatoes	ac.												
Wine Grapes	ac.												
Alfalfa	ac.												
Pasture	ac.												
Safflower	ac.												
Sugar Beets	ac.												
Beans	ac.												
Other	ac.												
Roads													
length of arterial roads inundated (miles)													
length of major roads inundated (miles)		0.34	0.36	0.38				0	0.12	0.14			
length of minor roads inundated (miles)		0.38	0.58	0.67				0	0.29	0.30			
length of unsealed roads inundated (miles)													

Extrapolate Y-intercept

N

Summary of Cost-Benefit Analysis

[Return to Menu](#)

Project Name:

City of Fortuna Rohner Creek Flood Control and Riparian Habitat Improvement Project

Description

0

Proposed project capital cost:

[Note: construction costs which are assumed to occur in one year.]

Change in annual O&M costs:

\$

-

[Note: the change in annual O&M costs compared to without project condiit

PV of future O&M costs:

\$

-

(at 6% discount rate over 50 years)

PV of future costs

\$

-

[Note: the sum of capital costs plus the PV of O&M costs.]

Benefits

	Actual	Potential	
EAD without project	\$ 995,950	\$ 1,038,842	[Note: for stormwater projects use "Potential" damage which ignores st
EAD with project	\$ 164,469	\$ 169,860	
Annual Benefit:	\$ 831,481	\$ 868,982	
PV of Future Benefits:	\$ 13,105,689	\$ 13,696,776	(at 6% discount rate over 50 years)

Cost-Benefit Analysis

	Actual	Potential	
Net Present Value (NPV)	\$ 13,105,689	\$ 13,696,776	(at 6% discount rate over 50 years)
Benefit:Cost Ratio	0.000	0.000	

NPV Sensitivity to Discount Rate:

	Actual	Potential
4%	\$ 17,862,031	\$ 18,667,636
5%	\$ 15,179,457	\$ 15,864,074
6%	\$ 13,105,689	\$ 13,696,776
7%	\$ 11,475,060	\$ 11,992,603
8%	\$ 10,171,911	\$ 10,630,680

Table 10- Annual Cost of Flood Damage Reduction Project

(All costs should be in 2009 Dollars)

Project: Rohner Creek Flood Control and Riparian Habitat Improvement Project

	Initial Costs	Operations and Maintenance Costs ⁽¹⁾						Discounting Calculations	
YEAR	(a) Grand Total Cost From Table 6 (row (i), column(d))	(b) Admin	(c) Operation	(d) Maintenance	(e) Replacement	(f) Other	(g) Total Costs (a) +...+ (f)	(h) Discount Factor	(i) Discounted Costs(g) x (h)
2009	\$40,640						\$40,640	1.000	\$40,640
2010	\$41,242						\$41,242	0.943	\$38,891
2011	\$91,762						\$91,762	0.890	\$81,668
2012	\$555,560						\$555,560	0.840	\$466,670
2013	\$6,162,560						\$6,162,560	0.792	\$4,880,748
2014	\$10,000	\$500	\$3,000	\$1,000			\$14,500	0.747	\$10,832
2015		\$500	\$3,000	\$1,000			\$4,500	0.705	\$3,173
2016		\$500	\$3,000	\$1,000			\$4,500	0.655	\$2,948
2017		\$500	\$3,000	\$1,000			\$4,500	0.627	\$2,822
2018		\$500	\$3,000	\$1,000			\$4,500	0.592	\$2,664
2019		\$500	\$200	\$1,000			\$1,700	0.558	\$949
2020		\$500	\$200	\$1,000			\$1,700	0.527	\$896
2021		\$500	\$200	\$1,000			\$1,700	0.497	\$845
2022		\$500	\$200	\$1,000			\$1,700	0.469	\$797
2023		\$500	\$3,000	\$1,000			\$4,500	0.442	\$1,989
2024		\$500	\$200	\$1,000			\$1,700	0.417	\$709
2025		\$500	\$200	\$1,000			\$1,700	0.394	\$670
2026		\$500	\$200	\$1,000			\$1,700	0.371	\$631
2027		\$500	\$200	\$1,000			\$1,700	0.35	\$595
2028		\$500	\$3,000	\$1,000			\$4,500	0.331	\$1,490
2029		\$500	\$200	\$1,000			\$1,700	0.312	\$530
2030		\$500	\$200	\$1,000			\$1,700	0.294	\$500
2031		\$500	\$200	\$1,000			\$1,700	0.278	\$473
2032		\$500	\$200	\$1,000			\$1,700	0.262	\$445
2033		\$500	\$3,000	\$1,000			\$4,500	0.247	\$1,112
2034		\$500	\$200	\$1,000			\$1,700	0.233	\$396
2035		\$500	\$200	\$1,000			\$1,700	0.22	\$374
2036		\$500	\$200	\$1,000			\$1,700	0.207	\$352
2037		\$500	\$200	\$1,000			\$1,700	0.196	\$333
2038		\$500	\$3,000	\$1,000			\$4,500	0.185	\$833
2039		\$500	\$200	\$1,000			\$1,700	0.174	\$296
2040		\$500	\$200	\$1,000			\$1,700	0.164	\$279
2041		\$500	\$200	\$1,000			\$1,700	0.155	\$264
2042		\$500	\$200	\$1,000			\$1,700	0.146	\$248
2043		\$500	\$3,000	\$1,000			\$4,500	0.138	\$621
2044		\$500	\$200	\$1,000			\$1,700	0.13	\$221
2045		\$500	\$200	\$1,000			\$1,700	0.123	\$209
2046		\$500	\$200	\$1,000			\$1,700	0.116	\$197
2047		\$500	\$200	\$1,000			\$1,700	0.109	\$185
2048		\$500	\$3,000	\$1,000			\$4,500	0.103	\$464
2049		\$500	\$200	\$1,000			\$1,700	0.097	\$165
2050		\$500	\$200	\$1,000			\$1,700	0.092	\$156
2051		\$500	\$200	\$1,000			\$1,700	0.087	\$148
2052		\$500	\$200	\$1,000			\$1,700	0.082	\$139
2053		\$500	\$3,000	\$1,000			\$4,500	0.077	\$347
2054		\$500	\$200	\$1,000			\$1,700	0.073	\$124
2055		\$500	\$200	\$1,000			\$1,700	0.069	\$117
2056		\$500	\$200	\$1,000			\$1,700	0.065	\$111
2057		\$500	\$200	\$1,000			\$1,700	0.061	\$104
2058		\$500	\$3,000	\$1,000			\$4,500	0.058	\$261
Project Life	\$6,901,764								
Total Present Value of Discounted Costs (Sum of Column (i)) Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries									\$5,550,626

Comments:

(1) The incremental change in O&M costs attributable to the project.

Table 12 - Present Value of Expected Annual Damage Benefits Project: <u>Rohner Creek Flood Control and Riparian Habitat Improvement Project</u>			
(a)	Expected Annual Damage Without Project (1)		\$1,038,842
(b)	Expected Annual Damage With Project (1)		\$169,860
(c)	Expected Annual Damage Benefit	(a) – (b)	\$868,982
(d)	Present Value Coefficient (2)		15.76
(e)	Present Value of Future Benefits Transfer to column (e) Table 20: Proposal Costs and Benefits Summaries.	(c) x (d)	\$13,695,159

(1) This program assumes no population growth thus EAD will be constant over analysis period.

(2) 6% discount rate; 50-year analysis period (could vary depending upon life cycle of project).